City of Bellevue
Development Services Department
Land Use Staff Report

Proposal Name:	Naimushin Buffer Reduction and Retaining Wall Construction
Proposal Address:	5014 156th Ave SE
Proposal Description:	Critical Areas Land Use Permit application to reduce the top of slope buffer from 50 feet to 35 feet, construct a retaining wall in reduced buffer area, install a lawn on the uphill side of the wall, and replant a portion of the slope and slope buffer with native vegetation.
Folder Number:	09-112943-LO
Decision Included:	Critical Areas Land Use Permit (Process II. LUC 20.30P)
Planner:	David Pyle, Land Use Planner
Director's Decision:	**Approval with Conditions** Michael A. Brennan, Director Development Services Department By: _____ Carol V. Helland, Land Use Director

Application Date:	5/04/2009
Notice of Application Publication Date:	5/28/2009
Notice of Decision Date:	7/16/2009
Project Appeal Deadline:	7/30/2009

For information on how to appeal a proposal, visit Development Services Center at City Hall or call (425) 452-6800. Comments on State Environmental Policy Act (SEPA) Determinations can be made with or without appealing the proposal within the noted comment period for a SEPA Determination. Appeal of the Decision must be received in the City's Clerk's Office by 5 PM on the date noted for appeal of the decision.

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Attachments

1. Geotechnical Report
2. Site Plans

I. Proposal Description

This is an application for Critical Areas Land Use Permit to level a sloping rear yard by constructing a modular block wall and then installing a lawn within the leveled area, and replanting a portion of the steep slope and steep slope buffer. The residence currently has no lawn areas.

Land Use Code (LUC) 20.25H.120.B prescribes a 50-foot critical area buffer from the top of steep slope protected areas. This is a request to reduce the prescribed buffer to a minimum distance of 35 feet. LUC 20.25H.095.C.2 allows for the modification of a critical area buffer through a critical areas report. The critical areas report is a mechanism by which certain LUC requirements may be modified for a specific proposal.

The critical areas report is intended to provide flexibility for sites where the expected critical areas functions and values are not present due to degraded conditions. The steep slope critical area along the eastern portion of the site was created during the construction of 157th Ave SE. The buffer of the slope has been impacted by normal activity associated with residential development. The slope area was impacted during site exploration by the applicant's geotechnical engineer, however the slope was found to be stable. The proposal includes the restoration of the impacted area and the restoration of a portion of the slope buffer in an area that has been impacted through past site management practices.

Figure 1 – Oblique View

Figure 2 – Oblique View

II. Site Description, Zoning, Land Use and Critical Areas

A. Site Description

The site is a residential lot with a single family home and is surrounded by other single family homes. The property is bounded by 156th Avenue SE on the west and 157th Avenue SE on the east. The site slopes to the east. Elevations range from 130 feet at the east side of the project area to 110 feet at the eastern property line with an average grade of approximately 25%. The slope steepens to the east of the property line with an elevation drop over a distance of 12 to 15 feet and a grade of approximately 75%. The slope to the east of the property line meets the definition of a steep slope and is considered a critical area.

B. Zoning

The property is zoned R-3.5. The site is developed with one single family residence.

C. Land Use Context

As described above, the property is a single family lot located within a single family neighborhood. The requested landscape modifications are consistent with those commonly associated with single family property.

D. Critical Areas Functions and Values

i. Geologic Hazard Areas

Geologic hazards pose a threat to the health and safety of citizens when commercial, residential, or industrial development is inappropriately sited in areas of significant hazard. Some geologic hazards can be reduced or mitigated by engineering, design, or modified construction practices. When technology cannot reduce risks to acceptable levels, building in geologically hazardous areas is best avoided (WAC 365-190).

Steep slopes may serve several other functions and possess other values for the City and its residents. Several of Bellevue's remaining large blocks of forest are located in steep slope areas, providing habitat for a variety of wildlife species and important linkages between habitat areas in the City. These steep slope areas also act as conduits for groundwater, which drains from hillsides to provide a water source for the City's wetlands and stream systems. Vegetated steep slopes also provide a visual amenity in the City, providing a "green" backdrop for urbanized areas enhancing property values and buffering urban development.

ii. Proposal's Impact to Functions

This is a proposal to level a portion of a sloping lot through the construction of a modular block retaining wall, the installation of an expanded lawn in the leveled area, and the replanting of a portion of the slope and slope buffer. The buffer will be reduced to a minimum of thirty five feet to accommodate the wall and lawn. The area where the wall is proposed is currently degraded due to past vegetation clearing actions (see Figures 1 and 2 above). The installation of the wall and the replanting of the buffer with native shrubs will help establish a defined edge for future maintenance purposes. Limited impact to the buffer and slope function is expected due to the current degraded condition of the project area. No trees are proposed to be removed.

III. Consistency with Land Use Code Requirements:

A. Zoning District Dimensional Requirements:

The site is located in the R-3.5 zoning district. This is a proposal to modify the top of slope buffer to construct a retaining wall and install an expanded lawn area. The applicant will be required to restore a portion of the slope and slope buffer with native shrub plantings. The walls proposed are not located within the side or rear yard structure setbacks, the highest point along the wall system will be 5'5" as measured from the bottom of the footing block. The wall system is the minimum necessary to achieve the objective of creating useable lawn space on the sloping property. All slope and buffer replanting must be consistent with the City's Critical Areas Handbook. The proposed development meets the general zoning dimensional standards.

B. Consistency with Land Use Code Steep Slope Critical Areas Performance Standards- LUC 20.25H.125:

i. Structures and improvements shall minimize alterations to the natural contour of the slope, and foundations shall be tiered where possible to conform to existing topography;

Finding: The applicant is proposing the use of a tiered retaining wall system to limit modification to the slope. The wall system will create a flat lawn area between two walls. No significant grading is allowed as part of this proposal.

ii. Structures and improvements shall be located to preserve the most critical portion of the site and its natural landforms and vegetation;

Finding: The wall and lawn area is located as far back from the steep slope critical area as possible. The applicant is requesting a reduction of the steep slope critical area buffer from 50 feet to 35 feet. The applicant has obtained the services of a reputable geotrechnical engineering consultant and has evaluated if any impacts tho the slope are possible. The geotechnical report is included as **Attachment XX** to this report.

iii. The proposed development shall not result in greater risk or a need for increased buffers on neighboring properties;

Finding: The applicant has obtained the services of a reputable geotrechnical engineering consultant and has evaluated if any impacts to the slope are possible. The geotechnical report is included as **Attachment XX** to this report. No impacts to the slope stability are expected.

iv. The use of retaining walls that allow the maintenance of existing natural slope area is preferred over graded artificial slopes where graded slopes would result in increased disturbance as compared to use of retaining wall;

Finding: The applicant is proposing the use of a retaining wall system the footprint of which avoids significant tree removal and limits the removal of existing vegetation. No artificial grading is expected outside of backfilling the retaining walls and grading around the wall footing.

v. Development shall be designed to minimize impervious surfaces within the critical area and critical area buffer;

Finding: New impervious surface added as part of this project is limited to the retaining wall footprint and path/stair construction. The applicant will be required to provide a detailed site plan as part of the underlying permit (clearing and grading permit) and must comply with the impervious surface limits for the R-3.5 zone. See related condition of approval in **Section VIII** below.

vi. Where change in grade outside the building footprint is necessary, the site retention system should be stepped and regrading should be designed to minimize topographic modification. On slopes in excess of 40 percent, grading for yard area may be disallowed where inconsistent with this criteria;

Finding: The applicant is proposing the use of a tiered retaining wall system to limit modification to the slope. The wall system will create a flat lawn area between two walls. No grading is proposed within the protected slope area and work outside the wall footprint is limited to native shrub replanting. See related condition of approval in **Section VIII** below.

vii. Building foundation walls shall be utilized as retaining walls rather than rockeries or retaining structures built separately and away from the building wherever feasible. Freestanding retaining devices are only permitted when they cannot be designed as structural elements of the building foundation;

Finding: Not applicable. This application does not include any proposal to install retaining structures related to the construction of building foundations.

viii. On slopes in excess of 40 percent, use of pole-type construction which conforms to the existing topography is required where feasible. If pole-type construction is not technically feasible, the structure must be tiered to conform to the existing topography and to minimize topographic modification;

Finding: Not applicable. The scope of work under review is limited to the installation of a retaining wall to level a portion of the rear yard. No structures are proposed outside of the retaining wall.

ix. On slopes in excess of 40 percent, piled deck support structures are required where technically feasible for parking or garages over fill-based construction types; and

Finding: Not applicable. The scope of work under review is limited to the installation of a retaining wall to level a portion of the rear yard. No structures are proposed outside of the retaining wall.

x. Areas of new permanent disturbance and all areas of temporary disturbance shall be mitigated and/or restored pursuant to a mitigation and restoration plan meeting the requirements of LUC 20.25H.210. (Ord. 5680, 6-26-06, § 3)

Finding: The applicant is required to submit a final restoration plan as allowed by LUC 20.25H.220. The restoration plan must include the replanting of a portion of the protected slope those portions of the slope buffer that are considered degraded. See related condition of approval in **Section VIII** below.

C. Consistency with Critical Areas Report LUC 20.25.230:

The applicant supplied a complete critical areas report prepared by Associated Earth Sciences, a qualified professional. The report met the minimum requirements in LUC 20.25H.250.

D. Critical Areas Report – Additional Provisions - LUC 20.25H.145:

Modifications to geologic hazard critical areas and critical area buffers shall only be approved if the Director determines that the modification:

i. Will not increase the threat of the geological hazard to adjacent properties over conditions that would exist if the provisions of this part were not modified;

Finding: The applicant has obtained the services of a reputable geotrechnical engineering consultant and has evaluated if any impacts to the slope are possible. The

geotechnical report is included as **Attachment XX** to this report. No impacts to the slope stability are expected.

ii. Will not adversely impact other critical areas;

Finding: The steep slope critical area extends off the property onto adjacent lots. There is no expected impact to the steep slopes adjacent to the site. There are no other known critical areas within the project vicinity.

iii. Is designed so that the hazard to the project is eliminated or mitigated to a level equal to or less than would exist if the provisions of this part were not modified;

Finding: The applicant has obtained the services of a licensed geotechnical engineer to assist in project design and to ensure that the project will impact the adjacent slopes.

iv. Is certified as safe as designed and under anticipated conditions by a qualified engineer or geologist, licensed in the state of Washington;

Finding: See geotechnical report and analysis included as **Attachment I**.

v. The applicant provides a geotechnical report prepared by a qualified professional demonstrating that modification of the critical area or critical area buffer will have no adverse impacts on stability of any adjacent slopes, and will not impact stability of any existing structures. Geotechnical reporting standards shall comply with requirements developed by the Director in City of Bellevue Submittal Requirements Sheet 25, Geotechnical Report and Stability Analysis Requirements, now or as hereafter amended;

Finding: See geotechnical report and analysis included as **Attachment I**.

vi. Any modification complies with recommendations of the geotechnical support with respect to best management practices, construction techniques or other recommendations; and

Finding: See related conditions of approval in **Section VIII** below.

vii. The proposed modification to the critical area or critical area buffer with any associated mitigation does not significantly impact habitat associated with species of local importance, or such habitat that could reasonably be expected to exist during the anticipated life of the development proposal if the area were regulated under this part.

Finding: Review of the WDFW PHS map and site visit indicate limited potential for this site to provide habitat for species of local importance as the site is degraded and has limited connectivity to other patches. No tree removal is proposed and vegetation impacts are limited to the areas of wall construction.

IV. Public Notice and Comment

Application Date:	May 4, 2009
Public Notice (500 feet):	May 28, 2009
Minimum Comment Period:	June 11, 2009

The Notice of Application for this project was published in the City of Bellevue weekly permit bulletin on May 28, 2009. It was mailed to property owners within 500 feet of the project site. No comments have been received from the public as of the writing of this staff report.

V. Summary of Technical Reviews

A. Clearing and Grading

The Clearing and Grading Division of the Planning and Community Development Department has reviewed the proposed site development for compliance with Clearing and Grading codes and standards. The Clearing and Grading staff found no issues with the proposed development. Additional review is required during review of the underlying (clearing and grading) permit. See related condition of approval in **Section VIII** below.

VI. Decision Criteria

A. Critical Areas Report Decision Criteria-Proposals to Reduce Regulated Critical Area Buffer LUC 20.25H.255. The Director may approve, or approve with modifications, a proposal to reduce the regulated critical area buffer on a site where the applicant demonstrates:

i. The proposal includes plans for restoration of degraded critical area or critical area buffer functions which demonstrate a net gain in overall critical area or critical area buffer functions;

Finding: This proposal, as designed, will not lead to a further degradation of critical areas. The proposal to reduce the buffer to 35 feet in an area that has been impacted through past clearing activity is expected to be mitigated through the proposed restoration activity.

ii. The proposal includes plans for restoration of degraded critical area or critical area buffer functions which demonstrate a net gain in the most important critical area or critical area buffer functions to the ecosystem in which they exist;

Finding: The applicant is required to submit a final restoration plan as allowed by LUC 20.25H.220. The restoration plan must include the replanting of a portion of the protected slope those portions of the slope buffer that are considered degraded. See related condition of approval in **Section VIII** below.

iii. The proposal includes a net gain in stormwater quality function by the critical area buffer or by elements of the development proposal outside of the reduced regulated critical area buffer;

Finding: A net gain in stormwater function is expected to be achieved through enhanced site drainage (wall footing drains) and a restored shrub layer.

iv. Adequate resources to ensure completion of any required restoration, mitigation and monitoring efforts;

Finding: Prior to the issuance of a clearing and grading permit, the applicant will be required to submit an assignment of savings financial security device for landscape installation. A further financial security device for landscape maintenance will be required prior to release of the installation device. See related condition of approval in **Section VIII** of this report.

v. The modifications and performance standards included in the proposal are not detrimental to the functions and values of critical area and critical area buffers off-site; and

Finding: This proposal will not lead to the degradation of functions and values on critical areas or buffers on adjacent property. The proposed work is designed to be limited to already impacted areas. See related condition of approval in **Section VIII** of this report.

vi. The resulting development is compatible with other uses and development in the same land use district. (Ord. 5680, 6-26-06, § 3)

Finding: The requested landscape modifications are consistent with those commonly associated with single family property.

B. Critical Areas Land Use Permit Decision Criteria 20.30P

The Director may approve or approve with modifications an application for a critical areas land use permit if:

i. The proposal obtains all other permits required by the Land Use Code;

Finding: A clearing and grading permit is required. See related condition of approval in **Section VIII** of this report.

ii. The proposal utilizes to the maximum extent possible the best available construction, design and development techniques which result in the least impact on the critical area and critical area buffer;

Finding: Final construction plans are required as part of the clearing and grading permit submittal. Plans must demonstrate adequate protection of the critical area and buffer. Replanting must be in accordance with the City's Critical Areas Handbook. See related condition of approval in **Section VIII** of this report.

iii. The proposal incorporates the performance standards of Part 20.25H to the maximum extent applicable, and ;

Finding: Finding: The applicant is proposing the use of a retaining wall system the footprint of which avoids significant tree removal and limits the removal of existing vegetation. No artificial grading is expected outside of backfilling the retaining walls and grading around the wall footing. See related condition of approval in **Section VIII** of this report.

iv. The proposal will be served by adequate public facilities including street, fire protection, and utilities; and;

Finding: This site is currently developed with a single family residence. This is a proposal to reduce the steep slope buffer from 50 feet to 35 feet to accommodate the construction of a new retaining wall system. No additional demand on public facilities is expected.

v. The proposal includes a mitigation or restoration plan consistent with the requirements of LUC Section 20.25H.210; and

Finding: The applicant is required to submit a final restoration plan as part of the associated clearing and grading permit. See related condition of approval in **Section VIII** of this report.

vi. The proposal complies with other applicable requirements of this code.

Finding: As discussed in Section IV & V of this report, the proposal complies with all other applicable requirements of the Land Use Code.

VII. Conclusion and Decision

After conducting the various administrative reviews associated with this proposal, including Land Use Code consistency, SEPA, City Code and Standard compliance reviews, the Director of Planning and Community Development does hereby **approve with conditions** the proposal to reduce the top of slope buffer from 50 feet to 35 feet, construct a retaining wall in reduced buffer area, install a lawn on the uphill side of the wall, and replant a portion of the slope and slope buffer with native vegetation.

Note- Expiration of Approval: In accordance with LUC 20.30P.150 a Critical Areas Land Use Permit automatically expires and is void if the applicant fails to file for a Clearing and Grading Permit or other necessary development permits within one year of the effective date of the approval.

VIII. Conditions of Approval

The applicant shall comply with all applicable Bellevue City Codes and Ordinances including but not limited to:

Applicable Ordinances	Contact Person
Clearing and Grading Code- BCC 23.76	David Pyle, 425-452-2973

Land Use Code- BCC 20.25H	David Pyle, 425-452-2973
Noise Control- BCC 9.18	David Pyle, 425-452-2973

The following conditions are imposed under the Bellevue City Code referenced:

1. **Restoration Plan:** To assist in the re-establishment of vegetation on the slope, the property owner or applicant shall prepare a plan for and install vegetation (restoration) within the reduced buffer areas (35 feet from the top of slope) impacted by past residential activity and those areas impacted by geotechnical exploration. The restoration plan shall be submitted for review and approval by the City of Bellevue prior to the issuance of building permit or clearing and grading permit. The plan shall include proposed restoration measures to restore those areas impacted by past residential activity, geotechnical exploration, and wall/lawn construction. The plan must be consistent with the City's Critical Areas Handbook for steep slope critical areas. The plan must also include prescribed maintenance activities to ensure plant survival, and monitoring requirements (including reporting) to document success/failure. No less than 2,000 sf of area within the buffer and slope area shall be replanted/restored.

Authority: Land Use Code 20.25H.210
Reviewer: David Pyle, Development Services Department

2. Clearing and Grading Permit Required: Prior to the commencement of the construction activity, a Clearing and Grading Permit is required and must comply with BCC 23.76. As part of this application, the applicant must submit the final draft restoration plan for all areas of the property to be restored. The plan shall include the documentation of existing site conditions and shall identify the restoration measures to return the site to it's existing conditions and long term objectives consistent with LUC 20.25H.220. The proposed restoration plan must be consistent with the City's Critical Areas Handbook.

Authority: Bellevue City Code 23.76.025.1
Reviewer: David Pyle, Development Services Land Use Division

3. Rainy Season restrictions: Due to the proximity to a steep slope Critical Area, no clearing and grading activity may occur during the rainy season, which is defined as November 1 through April 30 without written authorization of the Development Services Department. Should approval be granted for work during the rainy season, increased erosion and sedimentation measures, representing the best available technology must be implemented prior to beginning or resuming site work.

Authority: Bellevue City Code 23.76.093.A
Reviewer: David Pyle, Development Services Land Use Division

4. Pesticides, Insecticides, and Fertilizers: The applicant must submit as part of the required Clearing and Grading Permit information regarding the use of pesticides, insecticides, and fertilizers in accordance with the City of Bellevue's "Environmental Best Management Practices" .

Authority: Bellevue City Code 23.76.100

Reviewer: David Pyle, Development Services Land Use Division

5. Noise Control: The proposal will be subject to normal construction hours of 7 am to 6 pm Monday through Friday and 9 am to 6 pm on Saturdays, except for Federal holidays and as further defined by the Bellevue City Code. Upon written request to PCD, work hours may be extended to 10 pm if the criteria for extension of work hours as stated in BCC 9.18 can be met.

Authority: Bellevue City Code 9.18
Reviewer: David Pyle, Development Services Land Use Division

6. Erosion and Sediment Control: The site must be managed according to an approved erosion control plan to be evaluated during review of clearing and grading permit. Erosion and sediment control best management practices include the installation of silt fencing around the work area and covering exposed soils to prevent migration of soils to the adjacent shoreline.

Authority: Bellevue City Code 23.76.090
Reviewer: David Pyle, Development Services Land Use Division

7. Pre-Construction Meeting: Prior to the commencement of construction, a pre-construction meeting is required with the City's Clearing and Grading Inspector to review permit and construction requirements, including erosion control practices.

Authority: Bellevue City Code 23.76
Reviewer: David Pyle, Development Services Land Use Division

8. Assignment of Savings Security Device – Landscape Installation: To ensure proper attention is given this restoration project by the applicant, an assignment of savings or bond financial security device for landscape installation equal to 150% of the value of the project must be submitted prior to clearing and grading permit issuance in accordance with LUC 20.40.490.

Authority: Land Use Code 20.40.490
Reviewer: David Pyle, Development Services Land Use Division

9. Performance Standards: A plant survival rate of 90% must be met at year five. Annual monitoring reports are required as identified in condition 11 below.

Authority: Land Use Code 20.20.220
Reviewer: David Pyle, Development Services Land Use Division

10. Assignment of Savings Security Device – Landscape Maintenance: To ensure a proper maintenance schedule is followed, after the restoration plantings have been installed, an assignment of savings or bond financial security device for landscape maintenance equal to 20% of the value of the project must be submitted prior to release of the landscape installation device in accordance with LUC 20.40.490.

Authority: Land Use Code 20.40.490
Reviewer: David Pyle, Development Services Land Use Division

11. Maintenance and Monitoring Plan: A complete maintenance and monitoring plan outlining how the restored area will be maintained and monitored for a period of five years shall be submitted and approved prior to the issuance of any building permits for construction on this site. Restored areas shall be monitored for a period of not less than 5 years to establish that performance standards have been met. Monitoring reports must be submitted annually by the last day of the year and should include an assessment of growing season success.

Authority: Land Use Code 20.40.490
Reviewer: David Pyle, Development Services Land Use Division

12. Engineered Wall Design Requirement: A detailed plan for the engineered wall design that has been recommended in the geotechnical engineer of record is required to be submitted for review and approval by the City of Bellevue Building Department prior to the issuance of any building permit for construction at this site. The wall must be designed and approved by an engineer licensed in Washington State.

Authority: Land Use Code 20.25H.125
Reviewer: David Pyle, Development Services Department

13. Wall Height: Retaining wall height shall be a maximum of 5 feet 6 inches. The scope or work allowed under this permit is limited to construction a retaining wall in reduced buffer area, install a lawn on the uphill side of the wall, and replant a portion of the slope and slope buffer with native vegetation. No expansion of useable property beyond that identified in the project plans or modification to the existing single family residence or associated appurtenances is allowed as part of this permit approval.

Authority: Land Use Code 20.25H.055
Reviewer: David Pyle, Development Services Department

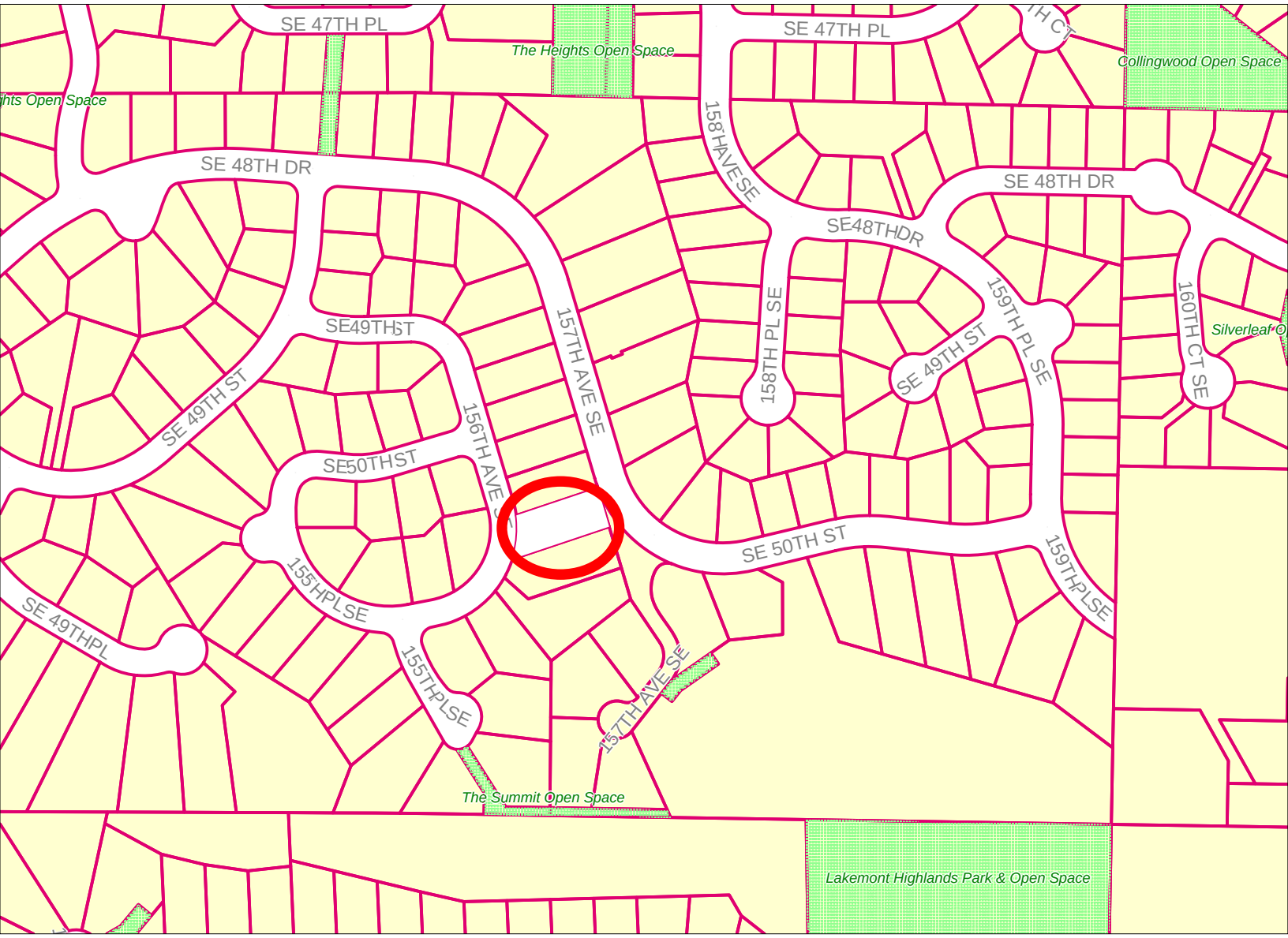
14. Geotechnical Recommendations: All stabilization design and installation must comply with the recommendations identified in the geotechnical report prepared by Associated Earth Sciences, including erosion hazard mitigation bmp's intended to limit the potential for erosion during construction.

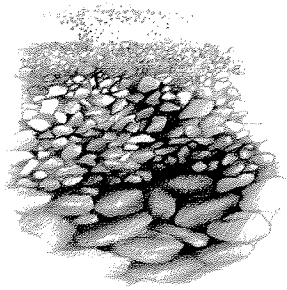
Authority: Bellevue City Code 23.76
Reviewer: Tom McFarlane, Development Services Department

15. Hold Harmless Agreement: Prior to building permit or clearing and grading permit approval, the applicant or property owner shall submit a hold harmless agreement releasing the City of Bellevue from any and all liability associated with the installation of slope stabilization measures. The agreement must meet city requirements and must be reviewed by the City Attorney's Office for formal approval.

Authority: Land Use Code 20.30P.170
Reviewer: David Pyle, Development Services Department

5014 156th Ave SE





Geotechnical Engineering

Associated Earth Sciences, Inc.

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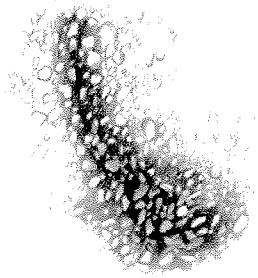
Water Resources

Critical Area Geotechnical Assessment

NAIMUSHIN/GIDIRIMSKI RESIDENCE

Bellevue, Washington



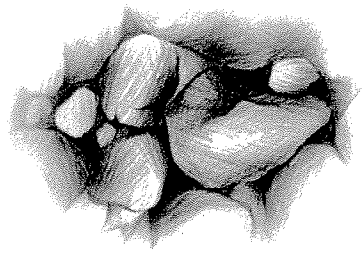
Environmental Assessments and Remediation

Prepared for

Alexei Naimushin and Tatyana Gidirimski

Sustainable Development Services

Project No. KE080750A
March 5, 2009



Geologic Assessments

Associated Earth Sciences, Inc.
Celebrating Over 25 Years of Service

March 5, 2009
Project No. KE080750A

Alexei Naimushin and Tatyana Gidirimski
5014 156th Avenue SE
Bellevue, Washington 98006

Subject: Critical Area Geotechnical Assessment
Naimushin/Gidirimski Residence
5014 156th Avenue SE
Bellevue, Washington

Dear Mr. Naimushin and Ms. Gidirimski:

We are pleased to present the enclosed copies of the referenced report. This report summarizes the results of our subsurface exploration and critical area geotechnical assessment and offers recommendations for the design and development of the proposed project.

We have enjoyed working with you on this study and are confident that the recommendations presented in this report will aid in the successful completion of your project. If you should have any questions or if we can be of additional help to you, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

J. Scott Kindred, P.E.
Senior Engineer

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CRITICAL AREA GEOTECHNICAL ASSESSMENT

NAIMUSHIN/GIDIRIMSKI RESIDENCE

Bellevue, Washington

Prepared for:
Alexei Naimushin and Tatyana Gidirimski
5014 156th Avenue SE
Bellevue, Washington 98006

Prepared by:
Associated Earth Sciences, Inc.
911 5th Avenue, Suite 100
Kirkland, Washington 98033
425-827-7701
Fax: 425-827-5424

March 5, 2009
Project No. KE080750A

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical assessment of the steep slope critical area, and geotechnical engineering study for the proposed landscaping modifications. The site plan and approximate locations of the explorations accomplished for this study are presented on the "Site and Exploration Plan," Figure 1. The locations of the proposed landscaping improvements, including the modular block walls, are shown on Figure 2.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface data and geotechnical recommendations to be used in the design of the project. Our study included a review of selected geologic literature, observing exploration pits, and performing geotechnical assessments to address and mitigate risks associated with proximity to the steep slope critical area. Geotechnical engineering studies were completed to formulate our recommendations for site preparation, site grading, modular block wall construction, and erosion control.

1.2 Authorization

Written authorization to proceed with this study was granted by Mr. Alexei Naimushin by means of a signed copy of our scope of work and cost proposal, dated February 11, 2008. This report has been prepared for the exclusive use of Alexei Naimushin and Tatyana Gidirimski and their agents for specific application to this project.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

This report was completed by Associated Earth Sciences, Inc. (AESI) with an understanding of the project based on discussions with Alexei Naimushin and Tatyana Gidirimski and the proposed landscaping plan shown on Figure 2. The site is a residential lot with a single-family home and is surrounded by other single-family homes. As shown on Figure 1, the property is bounded by 156th Avenue SE on the west side and by 157th Avenue SE on the east side. The site slopes to the east. Elevations range from 130 feet above mean sea level (amsl)

at the east side of the house to 110 feet amsl at the eastern property line with an average grade of approximately 25 percent. The slope steepens just west of the east property line with approximately 10 feet of elevation drop over a distance of 12 to 15 feet and a grade of approximately 75 percent. The slope just east of the property line meets the City of Bellevue's steep slope criteria of greater than 40 percent and at least 10 feet of elevation change.

The site includes a partially constructed modular block wall. Vegetation within the eastern portion of the lot includes 10 large trees and a number of shrubs. A sewer easement crosses the property approximately 15 feet east of the house (as shown on Figure 1).

The proposed project, as shown on Figure 2, will include construction of various landscaping features, including walkways, steps, and a modular block wall (MBW). The MBW will generally be less than 3.5 feet high, with the exception of a semi-circular area on the east side of the wall. The semi-circular area will reach a maximum height of approximately 5.5 feet.

3.0 SUBSURFACE EXPLORATION

Our field study included the three hand-dug exploration pits to gain subsurface information about the site. The exploration pits were excavated by the MBW contractor and ranged in depth from 3.5 to 4.5 feet. The pits permitted direct, visual observation of subsurface conditions. Materials encountered in the exploration pits were studied and classified in the field by an engineer from our firm. All exploration pits were backfilled immediately after examination and logging. In our opinion, the three explorations provide suitable site coverage for this assessment.

The various types of sediments, as well as the depths where characteristics of the sediments changed, are identified in the exploration logs provided in Appendix A and discussed in Section 4.0. The depths where conditions changed may represent gradational variations between sediment types.

The conclusions and recommendations presented in this report are based primarily on the exploration pits completed for this study. The number, locations, and depths of the explorations were completed within site and budgetary constraints. Because of the nature of exploratory work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions may sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations between the field explorations may not become fully evident until construction. If variations are observed at that time, it may be necessary to re-evaluate specific recommendations in this report and make appropriate changes.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, visual reconnaissance of the site, and review of selected geologic literature.

4.1 Geologic Setting

The site and surrounding community are located near the top of hill overlooking the southern end of Lake Sammamish. Topographic features in the vicinity of the site were formed by glacial and post-glacial processes. Elongate, northwest-southeast trending hills and swales parallel the flow direction of an ice sheet that occupied the Puget Lowland about 15,000 years ago.

4.2 Stratigraphy

The exploration logs are provided in Appendix A. Two stratigraphic units have been identified and delineated for this study: topsoil and Vashon lodgement till. The stratigraphic units were determined with regard to the following parameters: 1) stratigraphic position, 2) composition, and 3) importance of the unit in terms of the presence of ground water. The interpreted subsurface stratigraphy of the site and uplands plateau area are in general agreement with that presented in the *Geologic Map of King County, Washington* (Booth and Wisher, 2006). The stratigraphic units are described below.

Topsoil

Loose, moist, dark brown, silty sand containing abundant organic material and roots. The forest duff or grass and topsoil layer ranged from 0.5 feet to 1 foot thick in the three explorations. Due to their high organic content, these materials are not considered suitable for foundation, roadway, or slab-on-grade floor support, or for use in a structural fill.

Vashon Lodgement Till

Lodgement till was encountered below the topsoil in all three explorations. The upper 2 to 2.5 feet was a weathered zone consisting of moist, reddish brown, loose to medium dense silty sand with gravel and abundant roots. The unweathered lodgement till was moist to wet, olive brown, very dense, silty sand with gravel and occasional cobbles.

The lodgement till sediments were deposited at the base of an active continental glacier and were subsequently overrun and compacted by about 3,000 feet of glacial ice in the project area during the Vashon Stade of the Fraser Glaciation approximately 15,000 years ago. Lodgement till typically possesses high-strength and low-compressibility attributes that are favorable for support of retaining walls. Lodgement till is silty and moisture-sensitive. In the presence of

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on the geologic, slope, and shallow ground water conditions as observed and discussed herein.

5.0 SEISMIC HAZARDS AND MITIGATIONS

Earthquakes occur in the Puget Lowland with great regularity. Most of these events are small and are usually not felt by humans. However, large earthquakes do occur, as evidenced by the 2001, 6.8-magnitude event; the 1965, 6.5-magnitude event; and the 1949, 7.2-magnitude event. The 1949 earthquake appears to have been the largest in this region during recorded history and was centered in the Olympia area. Evaluation of earthquake return rates indicates that an earthquake of the magnitude between 5.5 and 6.0 is likely within a given 20-year period.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture, 2) seismically induced landslides, 3) liquefaction, and 4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

5.1 Surficial Ground Rupture

Generally, the largest earthquakes that have occurred in the Puget Sound area are sub-crustal events with epicenters ranging from 50 to 70 kilometers in depth. For this reason, no surficial faulting or earth rupture as a result of deep, seismic activity has been documented to date in the area of the subject site. Therefore, it is our opinion, based on existing geologic data, that the risk of surface rupture impacting the proposed project is low.

5.2 Seismically Induced Landslides

It is our opinion that the risk of damage to the proposed improvements by seismically induced landsliding is low due to gentle slope inclinations and the presence of medium dense to very dense soils observed beneath sloping areas of the site.

5.3 Liquefaction

Liquefaction is a temporary loss in soil shear strength that can occur when loose granular soils below the ground water table are exposed to cyclic accelerations, such as those that occur during earthquakes. The observed site soils were generally medium dense to very dense and

are not prone to liquefaction. A detailed liquefaction analysis was not completed as a part of this study, and none is warranted, in our opinion.

5.4 Ground Motion

Based on the site stratigraphy and visual reconnaissance of the site, it is our opinion that any earthquake damage to the proposed improvements, when founded on a suitable bearing stratum, would be caused by the intensity and acceleration associated with the event and not any of the above-discussed impacts. Based on the site plan for the proposed improvements, failure of the MBW due to ground motion is unlikely to cause any damage to buildings, roads, utilities, or other structures.

6.0 EROSION HAZARDS

The erosion hazard of the site soils is high due to the moderate grades and loose nature of the surficial soil. Without mitigation, dispersed sheet runoff can cause erosion of exposed non-vegetated soil during extreme storm events. Concentrated runoff can pose a greater risk of erosion due to increased water volume and velocity and should be avoided when feasible. Currently, there is no evidence of concentrated runoff or erosion at the site.

It is our opinion that with the proper implementation of the erosion control measures described below (Section 12.0) and by field-adjusting these measures during construction, the potential adverse impacts from erosion hazards on the project may be mitigated.

7.0 LANDSLIDE HAZARDS AND MITIGATIONS

The project site is characterized by moderate slopes within the property and a short steep slope just east of the property. In our opinion, the observed slope inclinations do not present a significant landslide risk given the very dense lodgement till underlying the site. If recommendations contained in this report are incorporated into project design and construction, no detailed landslide hazard analysis is warranted, in our opinion.

III. DESIGN RECOMMENDATIONS

8.0 INTRODUCTION

Our exploration indicates that, from a geotechnical standpoint, the proposed landscaping improvements are feasible provided the recommendations contained herein are properly followed.

9.0 SITE PREPARATION

Preparation of the MBW area should include removal of all grass, trees, brush, debris, existing fill/peat, and any other deleterious materials from beneath the planned MBW. All soils disturbed by stripping and grubbing operations should be recompacted, as described below for structural fill.

9.1 Temporary and Permanent Slopes

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. For estimating purposes, however, temporary unsupported cut slopes can be planned at 1H:1V (Horizontal:Vertical) or flatter in the dense lodgement till, and 1.5H:1V in the upper weathered zone with loose soils.

Permanent cut or fill slopes should not be steeper than 2H:1V.

These slope angles are for areas where ground water seepage is not encountered, and assume that surface water is not allowed to flow across the temporary slope faces. If ground or surface water is present when the temporary excavation slopes are exposed, flatter slope angles or other excavation stabilization techniques will be required. As is typical with earthwork operations, some sloughing and raveling may occur, and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times.

9.2 Site Disturbance

Most of the on-site soils contain substantial fine-grained material, which makes them moisture-sensitive and subject to disturbance when wet. The contractor must use care during site preparation and excavation operations so that the underlying soils in the area of the MBW are not softened. If disturbance occurs beneath the MBW, the softened soils should be removed and the area brought to grade with structural fill.

9.3 Winter Construction

Due to the high in-situ moisture content of most of the site soils, it may be necessary to dry some of the site soils during favorable dry weather conditions to allow reuse in structural fill applications. If construction takes place in winter, drying is not expected to be feasible, and we anticipate that most of the on-site soils will be unsuitable for structural fill applications.

It may be feasible to use site soils as structural fill in the summer. However, it is possible that significant effort may be needed to scarify, aerate, and dry site soils that are above optimum moisture content to reduce moisture content prior to compaction in structural fill applications. Care should be taken to seal all earthwork areas during grading at the end of each workday by grading all surfaces to drain and sealing them with a compactor. Stockpiled soils that will be reused in structural fill applications should be covered with plastic sheeting whenever rain is possible.

If winter construction is expected, crushed rock fill could be used to provide construction-staging areas. The stripped subgrade should be observed by the geotechnical engineer and should then be covered with a geotextile fabric, such as Mirafi 500X or equivalent. Once the fabric is placed, we recommend using a crushed rock fill layer at least 10 inches thick in areas where construction equipment will be used.

10.0 STRUCTURAL FILL

Structural fill will be necessary to backfill the reinforced section of the MBW. All references to structural fill in this report refer to subgrade preparation, fill type, placement, and compaction of materials, as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

After stripping, planned excavation, and any required overexcavation have been performed to the satisfaction of the geotechnical engineer/engineering geologist, the upper 12 inches of exposed ground should be recompacted to 90 percent of *American Society for Testing and Materials* (ASTM):D 1557. If the subgrade contains too much moisture, adequate recompaction may be difficult or impossible to obtain and should probably not be attempted. In lieu of recompaction, the area to receive fill should be blanketed with washed rock or quarry spalls to act as a capillary break between the new fill and the wet subgrade. Where the exposed ground remains soft and further overexcavation is impractical, placement of an engineering stabilization fabric may be necessary to prevent contamination of the free-draining layer by silt migration from below.

After recompaction of the exposed ground is tested and approved, or a free-draining rock course is laid, structural fill may be placed to backfill the MBW. Structural fill behind the

MBW should be free-draining (containing less than 5 percent passing the #200 sieve) soil or rock, acceptable to the geotechnical engineer, placed in maximum 6-inch loose lifts, with each lift being compacted to 95 percent of ASTM:D 1557.

The contractor should note that any proposed fill soils must be evaluated by AESI prior to their use in fills. This would require that we have a sample of the material at least 72 hours in advance to perform a Proctor test and determine its field compaction standard. A Proctor test is not necessary if washed crushed rock is used to backfill the MBW. On-site soils contain more than 5 percent passing the #200 sieve and are not suitable for MBW backfill.

11.0 MODULAR BLOCK WALL (MBW)

Figure 3 provides details for construction of the MBW. The MBW will be constructed of Anchor Diamond straight concrete landscaping blocks with face dimensions of 17.25 inches by 6 inches and a depth of 12 inches (Figure 3). Wall heights less than 2.5 feet may be constructed without geogrid reinforcing. Wall heights greater than 2.5 feet should be constructed with geogrid reinforcing, as shown on Figure 3. Construction details are discussed below.

- The subgrade for the MBW should be 1 foot below final grade for the unreinforced MBW and 1.5 feet below final grade for the reinforced MBW. The MBW should be founded on undisturbed weathered or unweathered lodgement till. If the lodgement till becomes disturbed or loosened, it should be removed and replaced with compacted crushed surfacing base course (CSBC) that meets Washington State Department of Transportation (WSDOT) Standard Specification 9-03.9(3).

- At least 6 inches of CSBC should be placed beneath the MBW and compacted with a vibrating plate compactor, hoe-pack, or jumping jack to a firm unyielding condition. The CSBC should be approximately 24 inches wide and extend at least 6 inches in front of the MBW.

- For wall heights less than 2.5 feet, the MBW blocks may be stacked on the CSBC to the desired height with no geogrid reinforcing, as shown on Figure 3.

- The semi-circle portion of the wall reaches a maximum height of 5.5 feet and geogrid reinforcing should be placed behind the wall to reinforce the backfill, as shown on Figure 3. The number of geogrid layers is shown on Figure 3 for different wall heights. The length of the geogrid behind each section of wall should range from 4.0 feet to 5.0 feet as shown on Figure 3.

- The geogrid should be Mirafi 3XT or equivalent, as approved by AESI. This material can be purchased from numerous suppliers, including H.D. Fowler in Bellevue at 425-746-8400.

- The backfill placed between the geogrid layers should be free-draining soil (containing less than 5 percent passing the #200 sieve) or washed crushed rock to prevent buildup of hydrostatic pressure. The backfill should be placed in 6-inch lifts and compacted with a vibrating plate compactor or hoe-pack to a firm non-yielding condition.

- As illustrated on Figure 3, the geogrid should be cut into 18-inch-wide strips and placed behind every other block around the semi-circle. In order to maintain the soil-geogrid connection, approximately 2 to 3 inches of soil should be placed between overlapping strips of geogrid. The blocks without geogrid should be marked so geogrid can be placed on these blocks after the next tier of blocks is added.

- Care must be taken to make sure the geogrid is properly oriented so the strongest strands are perpendicular to the wall and in accordance with the manufacturer's guidelines.

- The MBW should be provided with a drain behind the base of the wall. Drains should consist of rigid, perforated, polyvinyl chloride (PVC) pipe surrounded by washed pea gravel or other drain rock. The level of the perforations in the pipe should be set at or slightly below the base of the MBW, and the drain collectors should be constructed with sufficient gradient to allow gravity discharge away from the wall. In addition, the MBW should be lined with a minimum 12-inch-thick washed gravel blanket provided to within 1 foot of finish grade that ties into the drain.

- Drainage from behind the MBW should be discharged to a shallow pit backfilled with drainage rock at the approximate location shown on Figure 2. The shallow pit should be at least 3 feet deep and approximately 2 feet in diameter. The drainage rock in the pit may be covered with geotextile fabric and then covered with topsoil.

- It should be noted that the area bounded by lines extending downward at 1H:1V from the MBW must not intersect another MBW or intersect a filled area that has not been compacted to at least 95 percent of ASTM:D 1557. In addition, a 1.5H:1V line extending down and away from the MBW must not daylight because sloughing or raveling may eventually undermine the MBW. Thus, the MBW should not be placed near the edge of steps or cuts in the bearing soils.

- No buildings or parking surcharges should be allowed within 5 feet of the top of the MBW.

- AESI must observe construction of the wall to verify that it is built in accordance with our specifications.

Stability modeling of the MBW is provided in Appendix B. Simulations were conducted for a 3.5-foot-high wall with two layers of grid and a 5.5-foot-high wall with four layers of grid. These simulations indicate that the MBW configuration described above will support the anticipated loads with a safety factor of at least 1.5.

12.0 EROSION CONTROL MEASURES

12.1 Temporary Erosion Control Measures

Recommended erosion control measure during construction and before permanent erosion control measures are fully established are described below.

- Exposed soil should not remain uncovered for more than 2 days unless it is actively being worked. Ground-cover measures can include erosion control matting, plastic sheeting, straw mulch, crushed rock or recycled concrete, or mature hydroseed.

- During the wetter months of the year, or when large storm events are predicted during the summer months, each work area should be stabilized and covered at the end of each work day using mulch or plastic.

- Surface runoff and discharge should be controlled during and following construction. Uncontrolled discharge may promote erosion and sediment transport. Under no circumstances should concentrated discharges be allowed to flow across the slope.

- Soils that are to be reused around the site should be stored in such a manner as to reduce erosion from the stockpile. Protective measures may include, but are not limited to, covering with plastic sheeting, the use of low stockpiles in flat areas, or the use of straw bales/silt fences around pile perimeters.

- Construction of the proposed improvements should be conducted to prevent concentration of runoff.

- Temporary erosion control measures should be adjusted and maintained, as necessary.

12.2 Permanent Erosion Control Measures

Recommended permanent erosion control measures are described below.

- The short steep slope east of the property is currently covered with landscaping debris and vegetation, which provide erosion protection. Although the large debris may be removed to improve the appearance of the slope, we do not recommend clearing of the slope and exposing bare soil to rainfall and runoff.

- The moderate slopes on the property and the steep slope just east of the property may be landscaped to establish vegetation and provide additional erosion control. In their *Critical Areas Handbook*, the City of Bellevue has developed a Steep Slope Planting Template with a list of recommended plants. This template is provided in Appendix C. The recommended trees included in the template can grow to 60 or more feet and are not recommended given the small scale of the slope and the close proximity to homes. The shrubs and ground-cover recommendations are likely to be suitable for steep slopes at this site. Other plants may be appropriate based on recommendations from a qualified landscape professional.

- Any areas not immediately covered with vegetation should be covered with a mulch, such as bark or wood chips, to reduce soil erosion.

13.0 CONSTRUCTION MONITORING

We are available to provide additional geotechnical consultation as the project develops and to address any changes in the design. In this way, our recommendations may be properly interpreted and implemented. AESI should be on-site during MBW construction to provide geotechnical engineering and monitoring services. The integrity of the MBW depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not part of the current scope of work. If these services are desired, please let us know, and we will prepare a cost proposal.

14.0 CLOSURE

We have enjoyed working with you on this study and are confident that these recommendations will aid in the successful completion of your project. If you should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

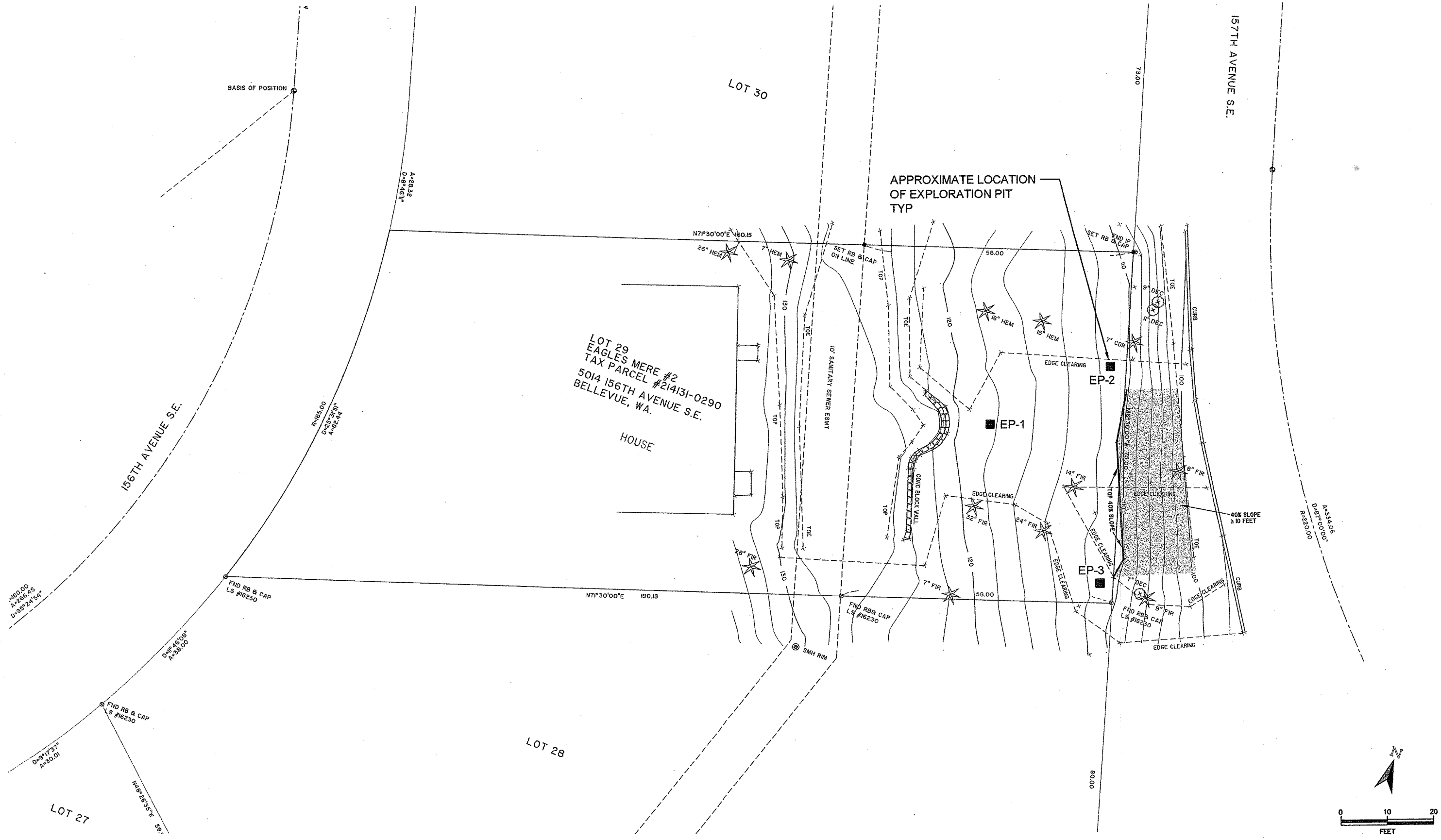
J. Scott Kindred, P.E.
Senior Engineer

Bruce L. Blyton, P.E.
Principal Engineer

Attachments:
Figure 1: Site and Exploration Plan
Figure 2: Landscaping Plan with Location of Modular Block Wall
Figure 3: Modular Block Wall Details
Appendix A: Exploration Logs
Appendix B: Modular Block Wall Stability Modeling
Appendix C: Steep Slope Planting Template

IV. REFERENCES

Booth, D.B. and Wisher, A., compilers, 2006, Geologic map of King County, Washington: Pacific Northwest Center for Geologic Mapping Studies, scale 1:100,000.



REFERENCE: GOLDSMITH

Associated Earth Sciences, Inc.

SITE AND EXPLORATION PLAN

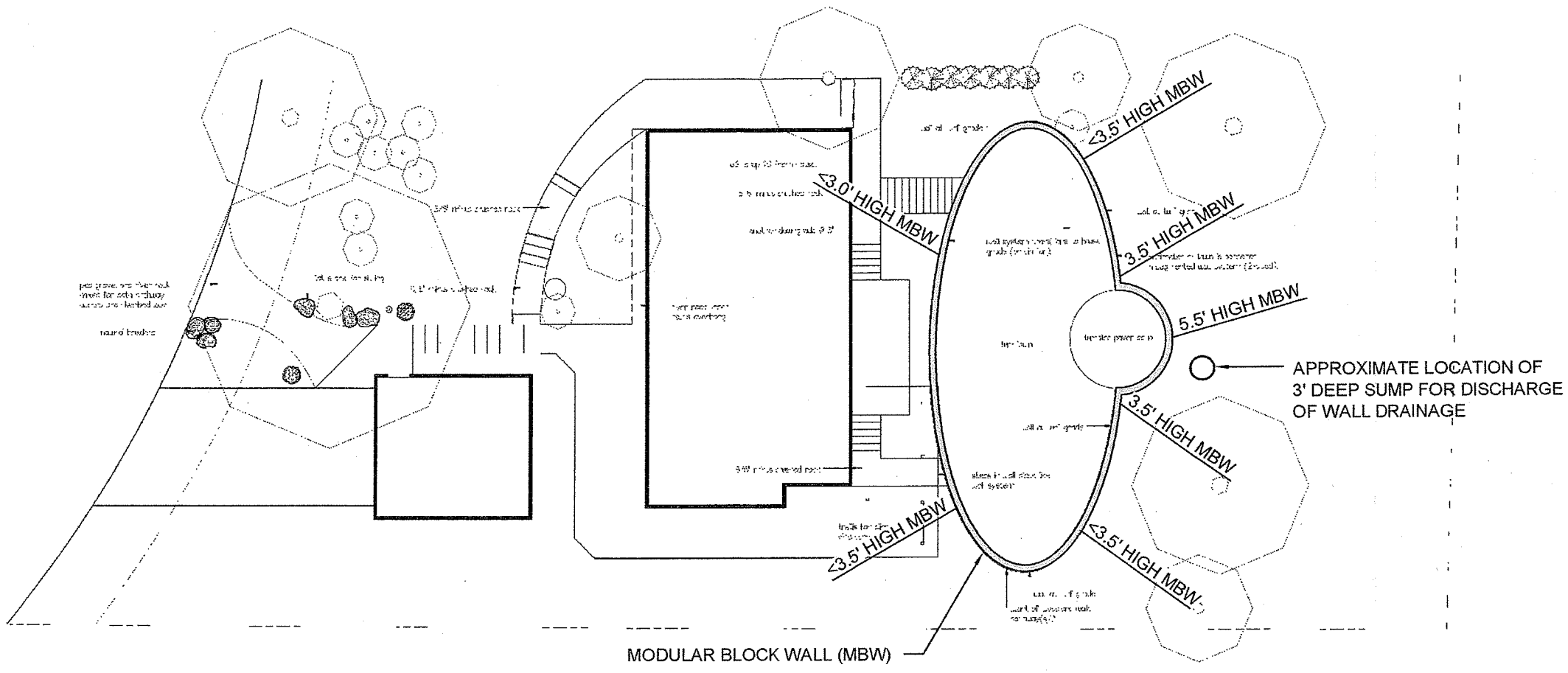
NAIMUSHIN - GIDERIMSKI
BELLEVUE, WASHINGTON

FIGURE 1

DATE 2/09

PROJECT NO. KE080750A

080750 Naimushin-Giderimski \ 080750 Site and Details.dwg LAYOUT: Site and Explr



N

0 10 20
FEET

REFERENCE: NYCE GARDENS

Associated Earth Sciences, Inc.

LANDSCAPE AND WALL PLAN

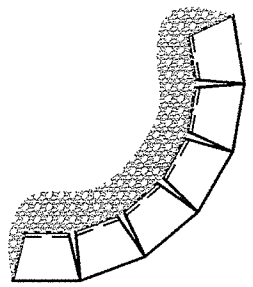
NAIMUSHIN - GIDERIMSKI
BELLEVUE, WASHINGTON

FIGURE 2

DATE 2/09

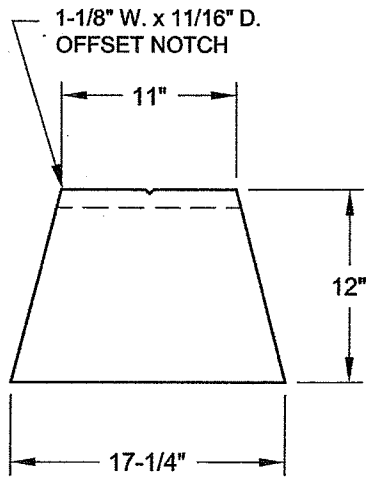
PROJECT NO. KE080750A

080750 Naimushin-Giderimski \ 080750 Site and Details.dwg LAYOUT: Site and Explr

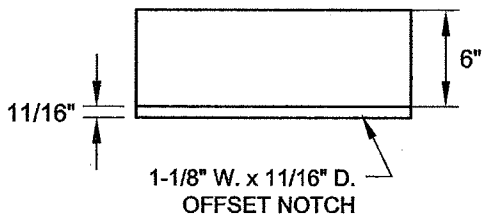


STRAIGHT UNITS

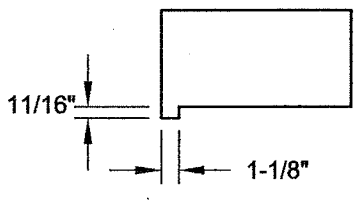
MINIMUM RADIUS: 4 FEET TO FACE



TOP VIEW

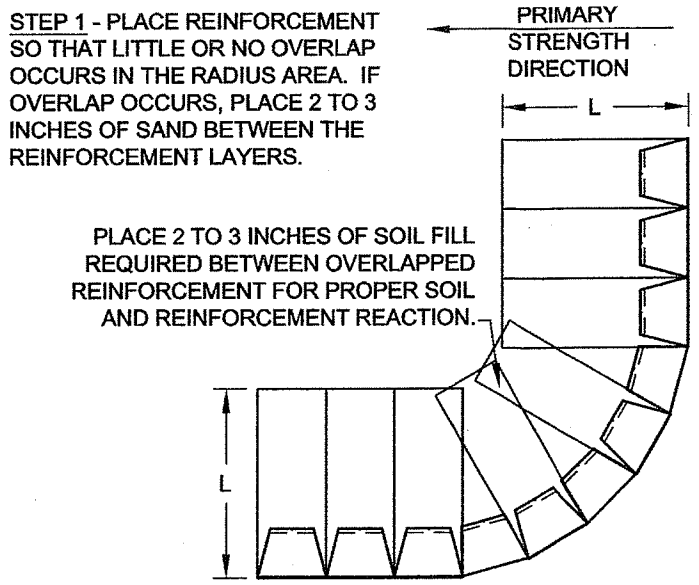


FACE VIEW

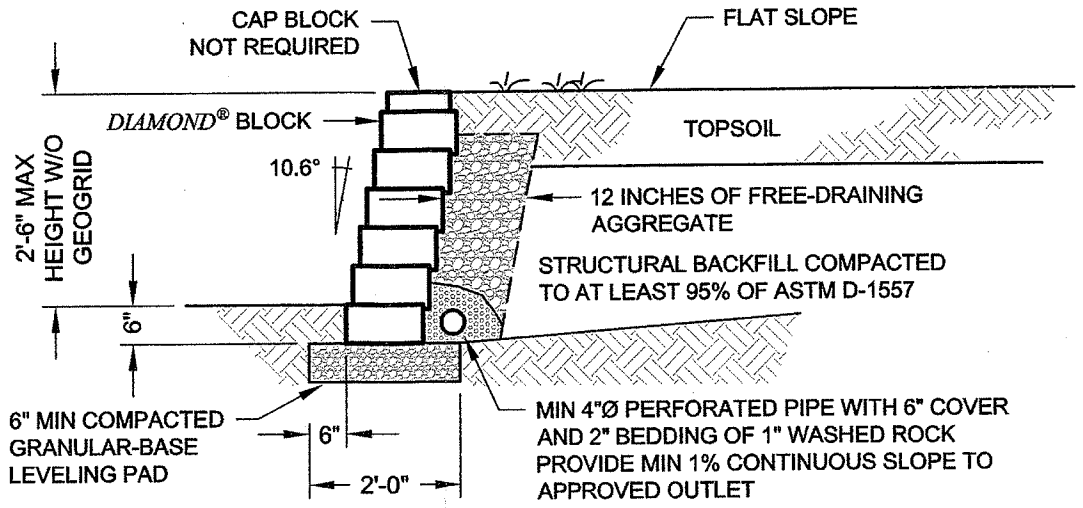


SIDE VIEW

STRAIGHT UNIT



REINFORCEMENT INSTALLATION



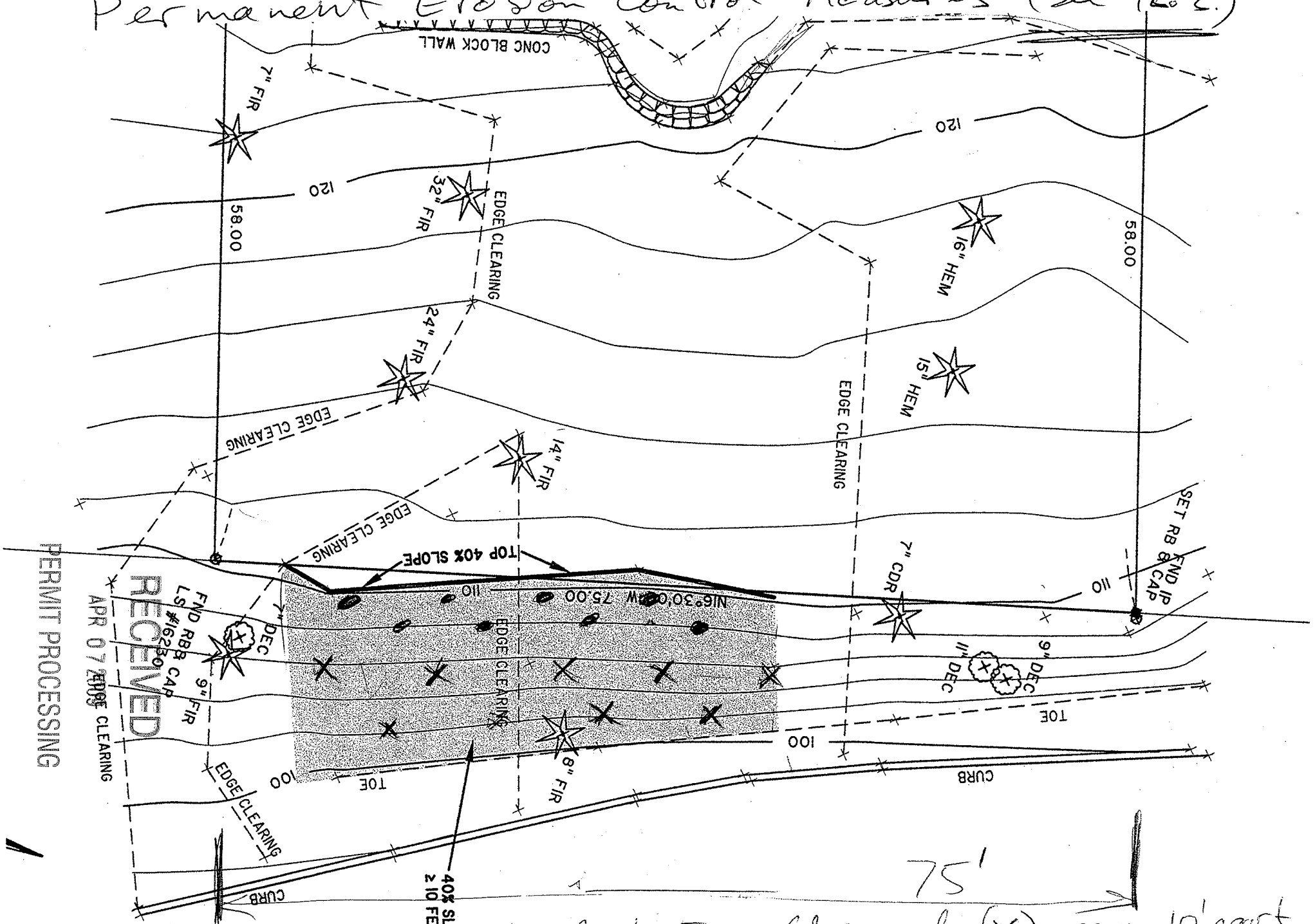
TYPICAL NON-REINFORCED MODULAR BLOCK WALL

WALL HEIGHT	GEOGRID LAYER	GEOGRID LENGTH
3.0	1	4.0'
3.5	2	4.0'
4.0	3	4.0'
4.5	3	4.5'
5.0	4	4.5'
5.5	4	5.0'

TYPICAL REINFORCED MODULAR BLOCK WALL

REFERENCE: ANCHOR WALL ENGINEERING, LLC

Permanent Erosion Control Measures (see 16.2.)



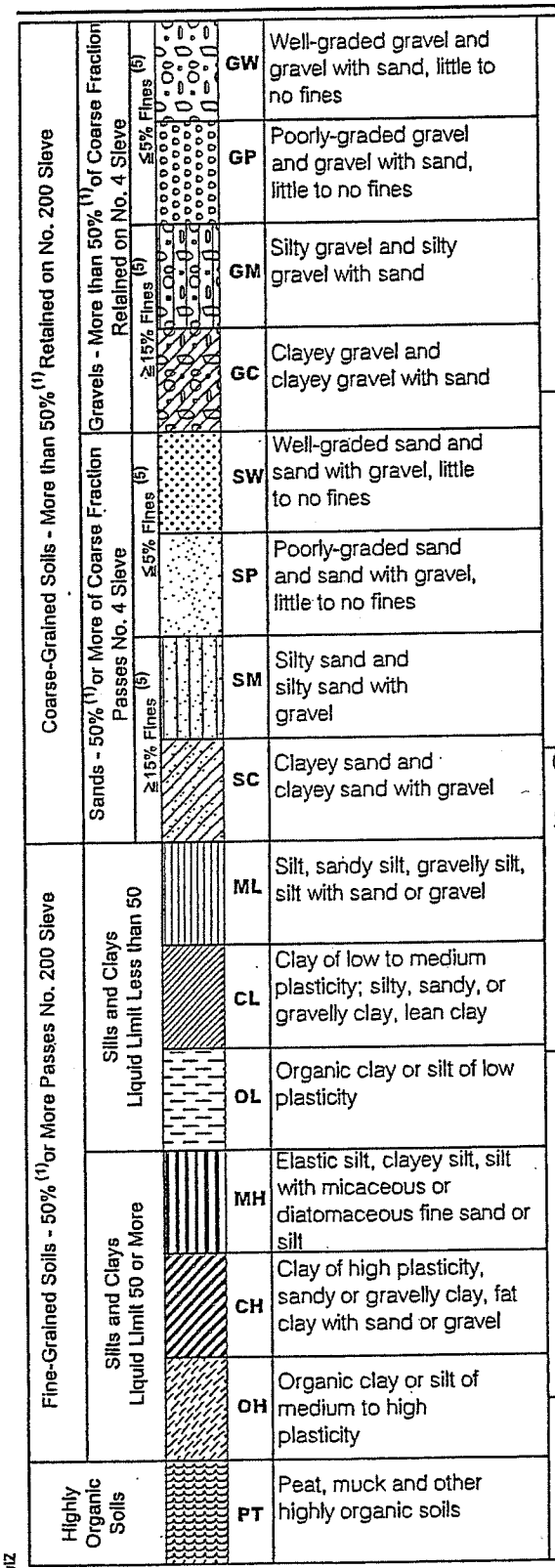
PERMIT PROCESSING

RECEIVED
APR 07 2005

We, the owners, propose to plant Emerald Spreader (X) approx 10' apart as groundcover
Also plant English Laurel + Pacific Wax Myrtle (•) at the top of the slope.

APPENDIX A

Exploration Logs



Terms Describing Relative Density and Consistency

	Density	SPT[2] blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50
	Consistency	**SPT[2] blows/foot**
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

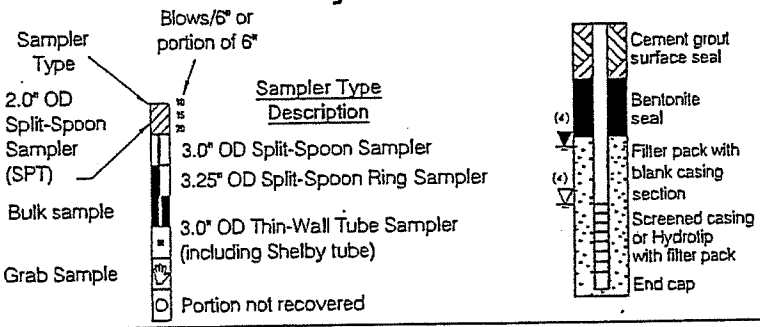
(3) Estimated Percentage

Component	Percentage by Weight
Trace	<5
Few	5 to 10
Little	15 to 25
With	- Non-primary coarse constituents: ≥ 15%
	- Fines content between 5% and 15%

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols



(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of ground water
▼ ATD = At time of drilling
▽ Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 15%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

Associated Earth Sciences, Inc.

EXPLORATION LOG KEY

FIGURE A1

blocksllog_key.dwg LAYOUT: Layout2

LOG OF EXPLORATION PIT NO. EP-1

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered.

Depth (ft)	DESCRIPTION
1	**Topsoil** Organic rich, loose, moist, dark brown, silty SAND, with roots.
2	**Weathered Lodgement Till** Loose to medium dense, moist, reddish brown, silty SAND, trace gravel, abundant roots.
3	**Lodgement Till** Dense to very dense, moist, olive-brown, silty SAND, with gravel.
4	Bottom of exploration pit at depth 3.5 feet
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Naimushiu/Gidirimski Residence
Bellevue, WA

Associated Earth Sciences, Inc.

Logged by: JSK

Approved by:

Project No. KE080750A

2/12/09

KCTP3 080750A.GPJ February 25, 2009

LOG OF EXPLORATION PIT NO. EP-2

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Topsoil** Organic rich, loose, moist, dark brown, silty SAND, with roots.
2	**Weathered Lodgement Till** Loose to medium dense, moist, reddish brown to brown, silty SAND, with gravel and cobbles, roots.
3	Large root at 3'.
4	**Lodgement Till** Dense to very dense, wet, olive-brown, silty SAND, with gravel.
5	Bottom of exploration pit at depth 4.5 feet Slow seepage at 3.5' to 4'.
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

Naimushiu/Gidirimski Residence
Bellevue, WA

Associated Earth Sciences, Inc.

Logged by: JSK

Approved by:

Project No. KE080750A

2/12/09

KCTP3 080750A.GPJ February 25, 2009

LOG OF EXPLORATION PIT NO. EP-3

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
1	**Topsoil** Organic rich, loose, moist, dark brown, silty SAND, with roots.
2	**Weathered Lodgement Till** Loose to medium dense, moist, reddish brown, silty SAND, trace gravel, abundant roots.
3	**Lodgement Till** Dense to very dense, moist, olive-brown, silty SAND, with gravel, cobbles.
4	
5	Bottom of exploration pit at depth 4.5 feet
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

KCTP3 080750A.GPJ February 27, 2009

Naimushiu/Gidirimski Residence
Bellevue, WA

Logged by: JSK

Approved by:

Associated Earth Sciences, Inc.

Project No. KE080750A

2/12/09

APPENDIX B

Modular Block Wall Stability Modeling

Associated Earth Sciences, Inc.

Celebrating 25 Years of Service

AASHTO DESIGN METHOD
Naimushin - Giderimski

PROJECT IDENTIFICATION

Title: Naimushin - Giderimski
Project Number: KE080750A
Client:
Designer: EJL
Station Number:

Description:

Anchor Diamond Block with Miragrid 3XT. 3.5-ft exposed height wall with min 0.5-ft embedment. Total height is 4-ft.

Company's information:

Name: Associated Earth Sciences, Inc.
Street: 911 Fifth Avenue

Kirkland, WA 98033
Telephone #:
Fax #: 425-827-7701
E-Mail: 425-827-5424

Original file path and name: X:\01Projects\08s\080750 Naimushin - Giderimski\KE08075.....
.....750 dia3XT short.BEN

Original date and time of creating this file: 2/26/09

PROGRAM MODE:

ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.

SOIL DATA

REINFORCED SOIL

Unit weight,	γ	135.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	34.0 °

RETAINED SOIL

Unit weight,	γ	135.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight,	$\gamma_{equiv.}$	135.0 lb/ft ^{3}
Equivalent internal angle of friction,	$\phi_{equiv.}$	34.0 °
Equivalent cohesion,	$c_{equiv.}$	0.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2169 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 56.70° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.2169 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 42.16 N γ = 41.06

SEISMICITY

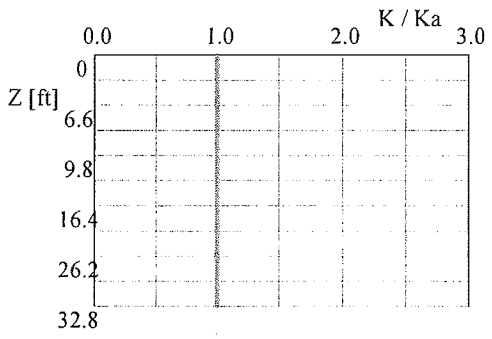
Maximum ground acceleration coefficient, α_o = 0.180
Kae (α_o > 0) = 0.3642 Kae (α_o = 0) = 0.2169 Δ Kae = 0.1473 (see eq. 37 in DEMO 82)
Seismic soil-geogrid friction coefficient, F* is 80.0% of its specified static value.

INPUT DATA: Geogrids (Analysis)

D A T A	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	3000.0				
Durability reduction factor, RFd	1.10				
Installation-damage reduction factor, RFid	1.10				
Creep reduction factor, RFc	1.60	N/A	N/A	N/A	N/A
Fs-overall for strength	N/A				
Coverage ratio, Rc	1.000				
Friction angle along geogrid-soil interface, ρ	26.60				
Pullout resistance factor, F*	0.80·tarϕ	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.0				

Variation of Lateral Earth Pressure Coefficient With Depth

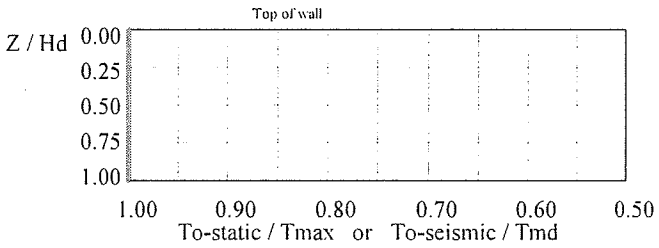
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



INPUT DATA: Facia and Connection (according to revised Demo 82) (Analysis)

FACIA type: Facing enabling frictional connection of reinforcement (e.g., modular concrete blocks, gabions)
Depth/height of block is 1.00/0.50 ft. Horizontal distance to Center of Gravity of block is 0.50 ft.
Average unit weight of block is γ_r = 100.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



Geogrid Type #1 σ [1]	CRult [2]	Geogrid Type #2 σ	CRult	Geogrid Type #3 σ	CRult	Geogrid Type #4 σ	CRult	Geogrid Type #5 σ	CRult
0.0	0.07								
824.0	0.42	N/A		N/A		N/A		N/A	

Geogrid Type #1 [3] σ	CRcr	Geogrid Type #2 σ	CRcr	Geogrid Type #3 σ	CRcr	Geogrid Type #4 σ	CRcr	Geogrid Type #5 σ	CRcr
0.0	0.06								
836.0	0.41	N/A		N/A		N/A		N/A	

[1] σ = Confining stress in between stacked blocks [lb/ft ^{2}]
[2] CRult = Tc-ult / Tult
[3] CRcr = Tcre / Tult

In seismic analysis, long term strength is reduced to 80% of its static value.

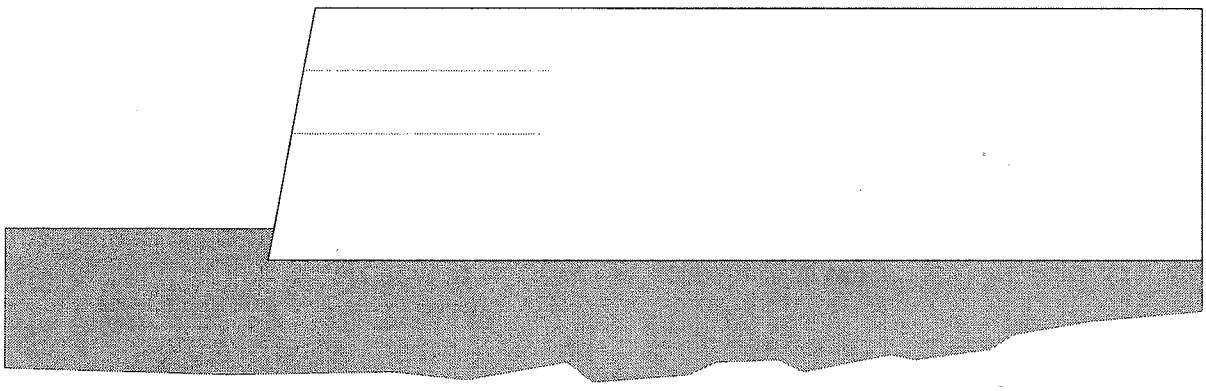
D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Mirafi 3XT	N/A	N/A	N/A	N/A
Connection strength reduction factor, RFd	1.20	N/A	N/A	N/A	N/A
Creep reduction factor, RFc	N/A	N/A	N/A	N/A	N/A

INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	4.00	[ft]	{ Embedded depth is E = 0.50 ft, and height above top of finished bottom grade is H = 3.50 ft }
Batter, ω	10.6	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

UNIFORM SURCHARGE
Uniformly distributed dead load is 0.0 [lb/ft ^{2}]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 22.17, Meyerhof stress = 495 lb/ft².

Foundation Interface: Direct sliding, Fs = 5.638, Eccentricity, e/L = -0.0053, Fs-overturning = 13.67

GEOGRID				CONNECTION						
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	2.00	4.00	1	1.79	7.70	7.698	4.430	8.804	-0.0135	Mirafi 3XT
2	3.00	4.00	1	7.73	47.04	47.044	11.456	18.039	-0.0093	Mirafi 3XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, Fs = 17.04, Meyerhof stress = 564 lb/ft².

Foundation Interface: Direct sliding, Fs = 2.567, Eccentricity, e/L = 0.0664, Fs-overturning = 4.89

GEOGRID				CONNECTION						
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	2.00	4.00	1	1.11	6.44	6.442	2.701	4.008	0.0035	Mirafi 3XT
2	3.00	4.00	1	2.51	23.42	23.420	3.506	8.213	-0.0051	Mirafi 3XT

Associated Earth Sciences, Inc.

Celebrating 25 Years of Service

AASHTO DESIGN METHOD
Naimushin - Giderimski

PROJECT IDENTIFICATION

Title: Naimushin - Giderimski
Project Number: KE080750A
Client:
Designer: EJL
Station Number:

Description:

Anchor Diamond Block with Miragrid 3XT. 5.5-ft exposed height wall with 1-ft embedment. Total height is 6.5-ft.

Company's information:

Name: Associated Earth Sciences, Inc.
Street: 911 Fifth Avenue

Kirkland, WA 98033
Telephone #:
Fax #: 425-827-7701
E-Mail: 425-827-5424

Original file path and name: X:\01Projects\08s\080750 Naimushin - Giderimski\KE08075..... .....\KE080750 dia3XT.BEN

Original date and time of creating this file: 2/26/09

PROGRAM MODE: ANALYSIS
of a SIMPLE STRUCTURE
using GEOGRID as reinforcing material.

SOIL DATA

REINFORCED SOIL

Unit weight,	γ	135.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	34.0 °

RETAINED SOIL

Unit weight,	γ	135.0 lb/ft ^{3}
Design value of internal angle of friction,	ϕ	34.0 °

FOUNDATION SOIL (Considered as an equivalent uniform soil)

Equivalent unit weight,	$\gamma_{equiv.}$	135.0 lb/ft ^{3}
Equivalent internal angle of friction,	$\phi_{equiv.}$	34.0 °
Equivalent cohesion,	$c_{equiv.}$	0.0 lb/ft ^{2}

Water table does not affect bearing capacity

LATERAL EARTH PRESSURE COEFFICIENTS

Ka (internal stability) = 0.2169 (if batter is less than 10°, Ka is calculated from eq. 15. Otherwise, eq. 38 is utilized)
Inclination of internal slip plane, ψ = 56.70° (see Fig. 28 in DEMO 82).
Ka (external stability) = 0.2169 (if batter is less than 10°, Ka is calculated from eq. 16. Otherwise, eq. 17 is utilized)

BEARING CAPACITY

Bearing capacity coefficients (calculated by MSEW): Nc = 42.16 N γ = 41.06

SEISMICITY

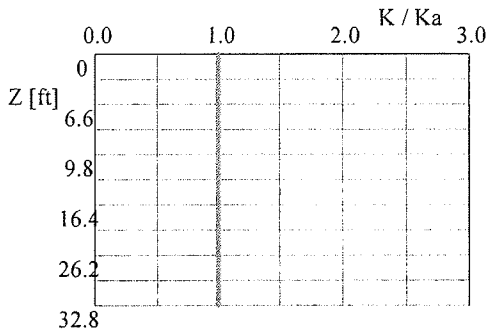
Maximum ground acceleration coefficient, α_o = 0.180
Kae (α_o > 0) = 0.3642 Kae (α_o = 0) = 0.2169 Δ Kae = 0.1473 (see eq. 37 in DEMO 82)
Seismic soil-geogrid friction coefficient, F* is 80.0% of its specified static value.

INPUT DATA: Geogrids
(Analysis)

D A T A	Geogrid type #1	Geogrid type #2	Geogrid type #3	Geogrid type #4	Geogrid type #5
Tult [lb/ft]	3000.0				
Durability reduction factor, RFd	1.10				
Installation-damage reduction factor, RFid	1.10				
Creep reduction factor, RFc	1.60	N/A	N/A	N/A	N/A
Fs-overall for strength	N/A				
Coverage ratio, Rc	1.000				
Friction angle along geogrid-soil interface, ρ	26.60				
Pullout resistance factor, F*	$0.80 \cdot \tan\phi$	N/A	N/A	N/A	N/A
Scale-effect correction factor, α	1.0				

Variation of Lateral Earth Pressure Coefficient With Depth

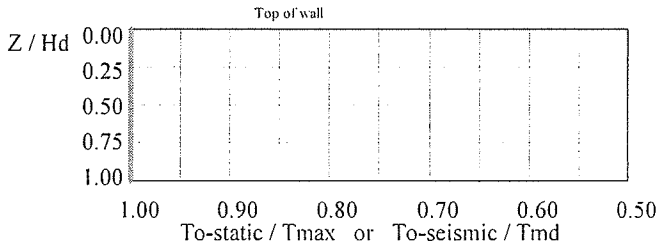
Z	K / Ka
0 ft	1.00
3.3 ft	1.00
6.6 ft	1.00
9.8 ft	1.00
13.1 ft	1.00
16.4 ft	1.00
19.7 ft	1.00



INPUT DATA: Facia and Connection (according to revised Demo 82) (Analysis)

FACIA type: Facing enabling frictional connection of reinforcement (e.g., modular concrete blocks, gabions)
Depth/height of block is 1.00/0.50 ft. Horizontal distance to Center of Gravity of block is 0.50 ft.
Average unit weight of block is γ_r = 100.00 lb/ft ^{3}

Z / Hd	To-static / Tmax or To-seismic / Tmd
0.00	1.00
0.25	1.00
0.50	1.00
0.75	1.00
1.00	1.00



Geogrid Type #1 σ [1]	Geogrid Type #1 CRult [2]	Geogrid Type #2 σ	Geogrid Type #2 CRult	Geogrid Type #3 σ	Geogrid Type #3 CRult	Geogrid Type #4 σ	Geogrid Type #4 CRult	Geogrid Type #5 σ	Geogrid Type #5 CRult
0.0	0.07								
824.0	0.42		N/A		N/A		N/A		N/A

Geogrid Type #1 [3] σ	Geogrid Type #1 CRcr	Geogrid Type #2 σ	Geogrid Type #2 CRcr	Geogrid Type #3 σ	Geogrid Type #3 CRcr	Geogrid Type #4 σ	Geogrid Type #4 CRcr	Geogrid Type #5 σ	Geogrid Type #5 CRcr
0.0	0.06								
836.0	0.41		N/A		N/A		N/A		N/A

[1] σ = Confining stress in between stacked blocks [lb/ft ^{2}]
[2] CRult = Tc-ult / Tult
[3] CRcr = Tcre / Tult

In seismic analysis, long term strength is reduced to 80% of its static value.

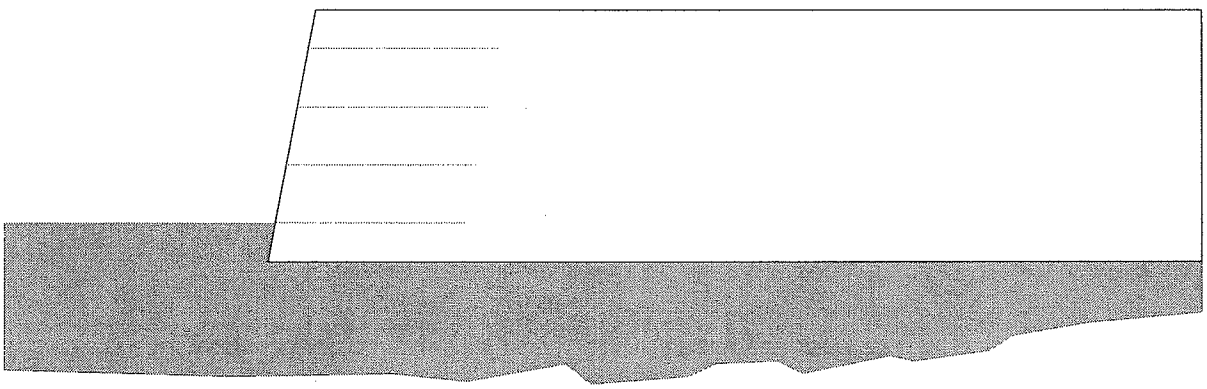
D A T A (for connection only)	Type #1	Type #2	Type #3	Type #4	Type #5
Product Name	Mirafi 3XT	N/A	N/A	N/A	N/A
Connection strength reduction factor, RFd	1.20	N/A	N/A	N/A	N/A
Creep reduction factor, RFc	N/A	N/A	N/A	N/A	N/A

INPUT DATA: Geometry and Surcharge loads (of a SIMPLE STRUCTURE)

Design height, Hd	6.50	[ft]	{ Embedded depth is E = 1.00 ft, and height above top of finished bottom grade is H = 5.50 ft }
Batter, ω	10.6	[deg]	
Backslope, β	0.0	[deg]	
Backslope rise	0.0	[ft]	Broken back equivalent angle, I = 0.00° (see Fig. 25 in DEMO 82)

UNIFORM SURCHARGE
Uniformly distributed dead load is 0.0 [lb/ft ^{2}]

ANALYZED REINFORCEMENT LAYOUT:



SCALE:

0 2 4 6 [ft]

ANALYSIS: CALCULATED FACTORS (Static conditions)

Bearing capacity, Fs = 17.16, Meyerhof stress = 789 lb/ft².
Foundation Interface: Direct sliding, Fs = 4.203, Eccentricity, e/L = 0.0115, Fs-overturning = 8.02

GEOGRID				CONNECTION						
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.00	5.00	1	2.46	5.38	5.376	12.172	3.766	-0.0007	Mirafi 3XT
2	2.50	5.00	1	3.24	8.82	8.821	12.688	5.340	-0.0114	Mirafi 3XT
3	4.00	5.00	1	3.75	14.11	14.113	10.350	8.804	-0.0135	Mirafi 3XT
4	5.50	5.00	1	5.68	34.56	34.563	7.848	22.657	-0.0078	Mirafi 3XT

ANALYSIS: CALCULATED FACTORS (Seismic conditions)

Bearing capacity, Fs = 9.50, Meyerhof stress = 1060 lb/ft².
Foundation Interface: Direct sliding, Fs = 1.914, Eccentricity, e/L = 0.1366, Fs-overturning = 2.87

GEOGRID				CONNECTION						
#	Elevation [ft]	Length [ft]	Type #	Fs-overall [connection strength]	Fs-overall [geogrid strength]	Geogrid strength Fs	Pullout resistance Fs	Direct sliding Fs	Eccentricity e/L	Product name
1	1.00	5.00	1	1.48	4.42	4.419	7.232	1.715	0.0869	Mirafi 3XT
2	2.50	5.00	1	1.78	6.79	6.785	6.859	2.431	0.0335	Mirafi 3XT
3	4.00	5.00	1	1.89	10.14	10.142	5.091	4.008	0.0035	Mirafi 3XT
4	5.50	5.00	1	2.19	19.84	19.835	2.870	10.316	-0.0052	Mirafi 3XT

APPENDIX C

Steep Slope Planting Template

STREAMS

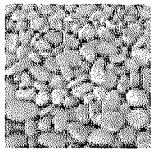
WETLANDS

SHORELINES

GEOLOGICAL
HAZARD AREAS

CRITICAL AREAS HANDBOOK

RESTORING, ENHANCING, AND PRESERVING



FOR MORE INFORMATION ABOUT THIS HANBOOK CONTACT:

City of Bellevue
450 110th Ave NE, Bellevue, WA 98004
http://www.bellevuewa.gov

Service First (Reception)	425-452-6800
Land Use Desk	425-452-4188
Environmental Planning Manager	425-452-2739
Stream Team	425-452-5200
Water Conservation, Natural Lawn and Garden Care	425-452-6932

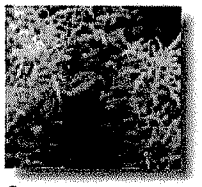
The **Critical Areas Handbook** is funded in part by grants from King County Conservation District and the Department of Community Trade and Economic Development Growth Management's Competitive Grant Program.

All research, copy, graphics and layout provided by:

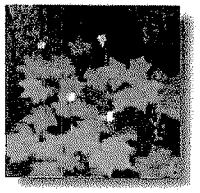
THE WATERSHED COMPANY

750 Sixth Street South, Kirkland, WA 98033 *p* 425.822.5242 *f* 425.827.8136

GEOLOGICAL HAZARDS TEMPLATE

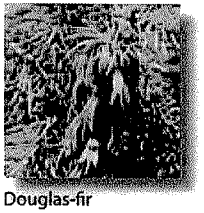


Oceanspray



Thimbleberry

Mock Orange



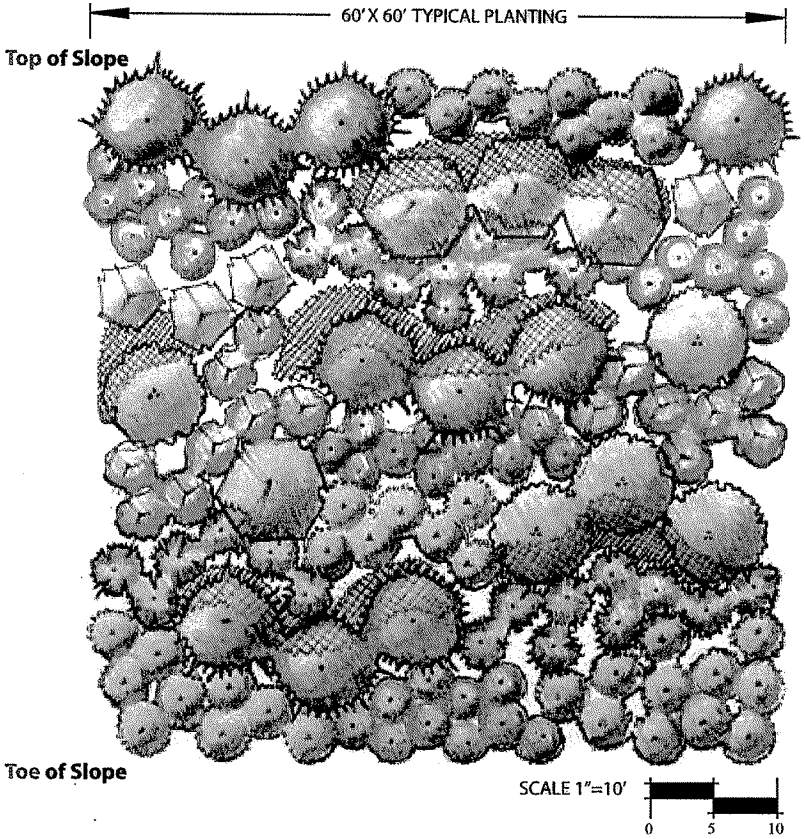
Douglas-fir

Geological Hazards

Steep Slope Planting Template
for ***Sunny*** and ***Shady*** Sites

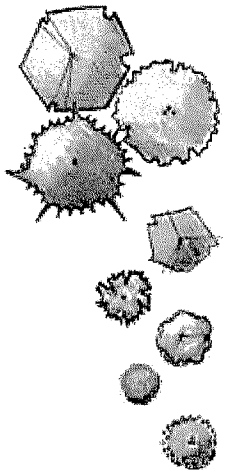
A1

GEOLOGICAL HAZARDS (STEEP SLOPE) PLANTING TEMPLATE



Steep slopes commonly have fragile, erodible soils. Planting can be difficult to establish in these areas as gravity, wind, and rain have a tendency to pull nutrient-rich soil down the slope. In addition, sunny sites require drought-tolerant plants, while both sunny and shady sites require plants with strong, root systems to keep soil intact. On the next two pages you will find one legend designed for sunny, steep sites and one designed for shady, steep sites. The plants chosen for these templates are known for drought tolerance and soil-binding characteristics. With the successful establishment of plants on steep slopes, the potential for erosion decreases. For additional information on Steep Slopes, refer to the section on *Geological Hazard Areas* in *Chapter One* and the City's Critical Areas Ordinance. Note, these templates are to be used for stable and undisturbed sloping sites. If your site has experienced a landslide or substantial erosion, do not use this template; consult a professional.

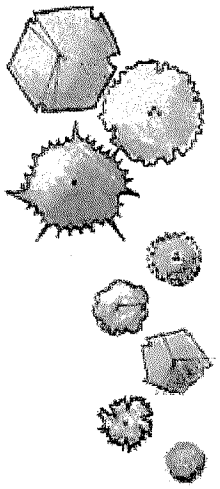
PLANT LEGEND FOR SUNNY SITES



LATIN NAME/ COMMON NAME	TYPICAL SPACING/ AVERAGE HEIGHT	CHARACTERISTICS
TREES		
Acer macrophyllum/ Big-leaf maple	9 feet on center/ 75 feet	Yellow fall color, provides understory shade, largest leaf of all maples
Alnus rubra/ Red alder	9 feet on center/ 60 feet	Vigorous grower, provides cover quickly for other plants
Pseudotsuga menziesii/ Douglas-fir	9 feet on center/ 100 feet	Highly adaptable, fast grower
SHRUBS		
Corylus cornuta/ Beaked hazelnut	6 feet on center/ 11 feet	Edible acorn, wildlife food. Small understory tree, yellowish fall color
Holodiscus discolor/ Oceanspray	4.5 feet on center/ 7 feet	Spectacular blossom; attracts hummingbirds and butterflies
Philadelphus lewisii/ Mock orange	4.5 feet on center/ 8 feet	Fragrant white blossom
Rubus parviflorus/ Thimbleberry	4 feet on center/ 8 feet	Delicious edible berries, fast grower, likes sun
Symphoricarpos albus/ Snowberry	4.5 feet on center/ 5 feet	White berries, proven performer in tough conditions
GROUNDCOVERS & PERENNIALS		
Arctostaphylos uva-ursi/ Kinnikinnick	*24 in. on center/ 6-8 in.	Evergreen groundcover, great for rockeries and full sun areas
Fragaria chiloensis/ Coastal strawberry	*24 in. on center/ 4-6 in.	Tough, highly adaptable groundcover w/ red stems and edible berries
Festuca idahoensis/ Idaho fescue	*24 in. on center/ 2.5 feet	Bluish leaves, clumping
Polystichum munitum/ Sword fern	*24 in. on center/ 5 feet once mature	Semi-evergreen fern, highly adaptable
Epilobium angustifolium/ Fireweed	*24 in. on center/ 1.5-2 feet	Big purple flowers on a tall stem

** Indicates plants are to be triangularly spaced for the area shown. See page 23 for triangular spacing.*

PLANT LEGEND FOR SHADY SITES



LATIN NAME/ COMMON NAME	TYPICAL SPACING/ AVERAGE HEIGHT	CHARACTERISTICS
TREES		
Acer macrophyllum/ Big-leaf maple	9 feet on center/ 75 feet	Yellow fall color, provides understory shade, largest leaf of all maples
Alnus rubra/ Red alder	9 feet on center/ 60 feet	Vigorous grower, provides cover quickly for other plants
Thuja plicata/ Western red cedar	9 feet on center/ 150 feet	Fragrant, adaptable to many sites
SHRUBS		
Acer circinatum/ Vine maple	4.5 feet on center/ 20 feet	Bright red fall color, small understory tree, grows well in shade
Amelanchier alnifolia/ Western serviceberry	4.5 feet on center/ 20 feet	Fragrant flowers, edible red to purple berries
Corylus cornuta/ Beaked hazelnut	6 feet on center/ 11 feet	Edible acorn, wildlife food, small understory tree, yellowish fall color
Oemleria cerasiformis/ Osoberry	4.5 feet on center/ 10 feet	Berries attract birds, first shrub to leaf out in spring
Sambucus racemosa/ Red elderberry	4 feet on center/ 15 feet	Edible berries, fast grower, graceful form with age
GROUNDCOVERS & PERENNIALS		
Arctostaphylos uva-ursi/ Kinnikinnick	*24 in. on center/ 6-8 in.	Evergreen groundcover, great for rockeries and full sun areas
Asarum caudatum/ Wild ginger	*24 in. on center/ 6-8 in.	Tough groundcover, great for planting under shrubs and trees
Polystichum munitum/ Sword fern	*24 in. on center/ 5 feet once mature	Semi-evergreen fern, highly adaptable

** Indicates plants are to be triangularly spaced for the area shown. See page 23 for triangular spacing.*